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Street in urban fabric of different types

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Abstract. The study traces the historical evolution of streets in urban fabric of different types and highlights the main types of streets. The study deals with the types of streets and identifies their problems. The principal factors, affecting the sustainability or resulting in its loss, are discovered in a special case. The impact of transport is considered as one of the criteria influencing street sustainability. The article reveals the results of the research of the dimensions of street sustainability and the red line, under which the integrity of space perception remains. Using street characteristics and problems, identified in the urban fabric of different types, we develop town-planning suggestions to support street sustainability development in modern cities. The study shows the types of urban fabric best suited for a modern city and capable of meeting the comfortable environment requirements in a greater degree.

1. Introduction

An essential forming element of urban infrastructure is a street whose morphology is directly related to the urban context with various transformations occurring over time and frequently resulting in the loss of historically developed identity and cultural potential.

Current transportation, social and cultural issues of historical cities lead to the loss of originally compositional sustainability that is old functions peculiar to urban environment are disappearing and new ones destroying a street being architectural ensemble are inevitably emerging. Thus, the issue of social, cultural and formally compositional sustainability acquires particular importance under such conditions. Understanding sustainability limits allows governing functional and formally compositional transformations.

2. Problem statement

Revolutionary changes in historical city image that we are witnessing bring about the destruction of traditional urban structures, a street being the most essential one [1,2]. Destruction processes occur due to urban structures' losing their social, cultural and formally compositional sustainability that eventually results in the loss of nationally artistic identity [3].

The term "sustainability" in this work is used to describe social and cultural processes influencing the quality and comfort of urban environment. For the first time, a street is considered as an integral structure. The study of regularities influencing sustainability of a street as an integral structural element existing at different times and reflecting material evidence of history is new and relevant. Urban evolution stages are reviewed by domestic and foreign researchers of urban fabric but they have not raised sustainability issue in some aspects that are prioritised by the authors.



Urban structure elements were studied by historians and architectural theorists such as A.E. Gutnov, I.G. Lezhava, Ch. Alexander, K.Lynch, V.L. Glazychev, A.V. Bunin, T.F. Savarenskaya, M.V. Shubenkov and others. A.E. Gutnov and I.G. Lezhava introduced the terms “frame”, “fabric” and “plasma” being used in the urban development theory to differentiate urban elements according to their sustainability in time [4]. Christopher Alexander suggested own methodology using patterns and templates enabling to describe a city as the whole bringing together every element and components [5]. According to Ch. Alexander, links between elements rather than elements themselves matter. The importance of stylistic and visual elements is not taken into account.

The idea of mental urban image is the key one in the research by Kevin Lynch who designed the method enabling to deal with visual forms at the urban scale [6]. Five key elements (paths, edges, districts, nodes and landmarks) identified by him make it possible to define original principles of city planning. The method allows to measure functional qualities of urban environments but fails to shape the holistic artistic image whose particular feature is identified by a comprehensive study of social, cultural and formally compositional urban structural elements.

The objectives of the study are:

- to analyze stages of development, evolution and current state of traditional streets;
- to define basic conditions for social, cultural and formally compositional sustainability of a street as a urban structural element.

3. Types of streets

Streets with various styles of buildings should be classified in order to identify sustainability conditions of a traditional street and the limits of acceptable changes where this essential component integrity remains. A traditional street is referred to as multifunctional, linear public space limited by building sides. The type of a street depends on the housing structure where the street was formed. Regulation of housing by red line is typical for historical urban fabric. Such type of street is characterized by house fronts facing a street way and either the absence of spaces or the presence of frequent intervals between houses [7]. The type of a street in the twentieth century differed by end walls facing a street way and greater space between houses. At the end of the twentieth century new principles not requiring facade leveling on the red line were actively engaged in urban development. The houses surrounded with trees and lawns were moved away from a street way and located wide apart. Under such principle of urban fabric formation a street is hardly perceived as an integral urban structure (housing system in new districts at the early twentieth century).

Thus, the following types of streets can be identified according to the nature of red line regulating effect (figure1):

- Traditional type of a street: uniform housing scale (facades extended along the red line), uniform fabric and frame;
- The early twentieth century type of a street: traditional structure destruction with red line preserving, destruction of connection between frame and fabric;
- Late twentieth – early twenty first century type of a street: minimum red line regulating effect, free standing houses at sites; the loss of strong connection between frame and fabric.

Therefore, we conclude that a street has lost the connection with red line; compositional unity of fabric and frame has been destroyed; the integrity of a street as an urban structural element has been violated and architecturally artistic sustainability has been lost in the evolution.

4. Social, cultural and historical aspects of sustainability

Social, cultural and historical sustainability is, on the one hand, preservation of individual and diverse historical housing, its revitalization and individuation of new architecture considering sustainability limits of traditional urban structural elements on the other hand.

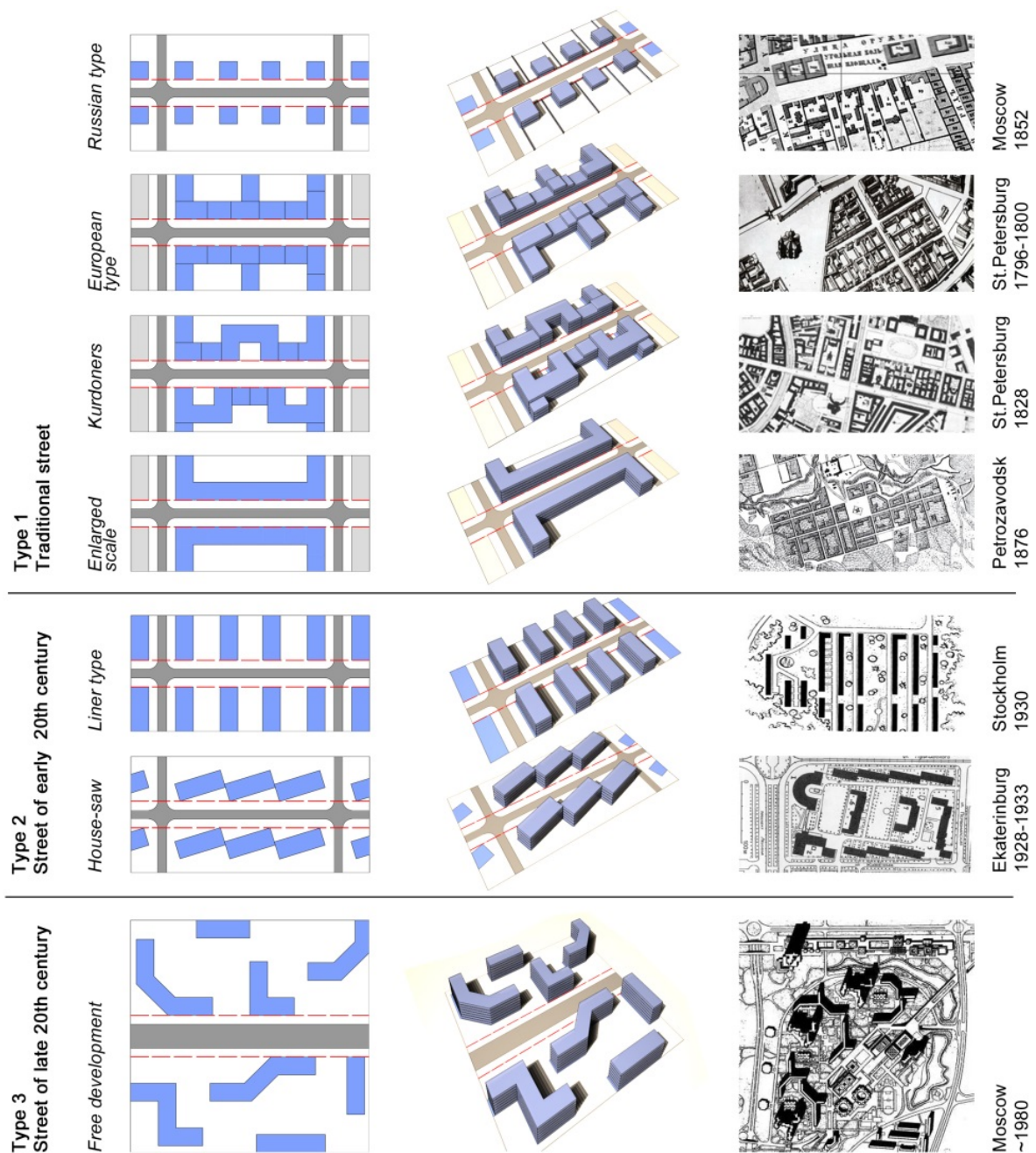


Figure 1. Types of streets. Source: A.V.Leyzerova.

The research of social and cultural aspects of sustainability allows to define limits where traditional urban structural elements responsible for city identity are destroyed. One of the social and cultural sustainability conditions is consistency of functions that are determined by the form of urban structural elements [8]. The continued constant existence of basic “reference structures” and frame elements is equally important.

A street could represent holistic geterochronic ensemble harmonically including multi-style elements if ordering relation (that is the nature of relation) of key elements is not broken. Such streets are common in traditional urban landscapes; they are the basis of comfortable and rich urban environment [9]. Nevertheless, structural heterogeneity of streets is deliberately disturbed. In this case,

the purpose is the creation of contrastive breaking of traditional urban fabric (postmodern inclusions in historical housing (figure 2)). In most cases, such experiments results in the loss of social and cultural sustainability since breaking assumes both changes of visual features and destruction of existing social and cultural relations.

Changes in urban space originate from those in cultural paradigms. As a result, new scale and silhouette building specifications appear. Social and cultural processes emerging in a society result from lifestyle changes. Increased demand for moving in urban space led to transport domination [10]. Because of heavy traffic on traditional streets they become less attractive, traditional functions disappear, people flee from houses located on these streets [11].



Figure 2. Examples of visual pause and visual accent. Source: Pedro Pegenaute, E.Y.Bagina.

4.1. Architecturally artistic sustainability

Geterochronic ribbon building, whose value is not yet fully realized, establishes conditions for creating comfortable environment. Formally compositional features of environment are to be considered when designing new structures and buildings located within traditional streets. Time-honoured formally compositional features of streets as integral urban structural elements are of great value [12,13]. One needs to consider frame-and-fabric ratio: street width on red lines, distance between houses, availability of court of honour and others [14]. Texture features are of importance as well.

Architecture of alternative and multi-style structures having similar characteristics of visual complexity facilitates enrichment of urban environment and preservation of historic memory [15]. According to V.A. Philin, the décor of structures is not “architectural extravagances” but “essential functional elements forming the basis of virtual environment without which complete work of eyes is impossible” [16]. Visual complexity can be investigated with respect to the way a person looks and watches; large-scale gradations are important as well. The more complicated visual environment, the more stable the street structure is in terms of social, cultural and architecturally artistic aspects. Pushkin Street – the historical street in Ekaterinburg – was chosen as a demonstration. There are buildings and structures of the nineteenth century, constructivist dwellings, municipal buildings of the 1930-50s and structures of the twenty first century.

Human eye movement flow diagram (figure 3) made for the street shows where the glance goes and where there are breaks visually that destroy the structure of a traditional street. The diagram shows how the human eye fixes on facades whose visual complexity arises from large-scale hierarchy of ten levels. Scale parts for the nineteenth century buildings are divided as follows: the smallest elements are from two to five centimeters; visual complexity scale has up to ten gradations, hence, the eye movement frequency is high. Constructivism buildings (in 1929 and 1930-1934) have the smallest elements ranging from 20 to 50 centimeters; visual complexity scale has up to five gradations. Accordingly, constructivism buildings have the smallest amount of elements to fix eyes on, thus the eye movement frequency is low. The buildings constructed in the late twentieth – early twenty first centuries have much less visual gradations [17].

It is worth noting that the traditional type of streets has higher sustainable potential which means that the provision of compositional integrity of this street under incorporation of modern housing development is easier than that for other types. Indeed, the undisturbed traditional type of the street under investigation comprises two compositional systems: the first system is made up of constructivism buildings; the second one is represented by the houses of the nineteenth century.

At all times “religious and political structures should dominate over urban area and from their interaction the silhouette interpreted as the artistic whole was born in vision field” [18]. In most European countries the dominance of temples and town halls over surrounding housing has remained. However, streets have undergone evolutionary changes without destroying their structure that is favourable for the integrity of urban space perception. The district of ribbon building with the inclusion of architectural monuments and ensembles is aligned height. A so-called “reference” house plays the part of high-rise dominant and peculiar point of reference for space perception in the traditional type of a street. I.G. Lezhava uses the term “reference” house to represent unique structures dominating over surrounding districts and fixing some point for space perception [19].

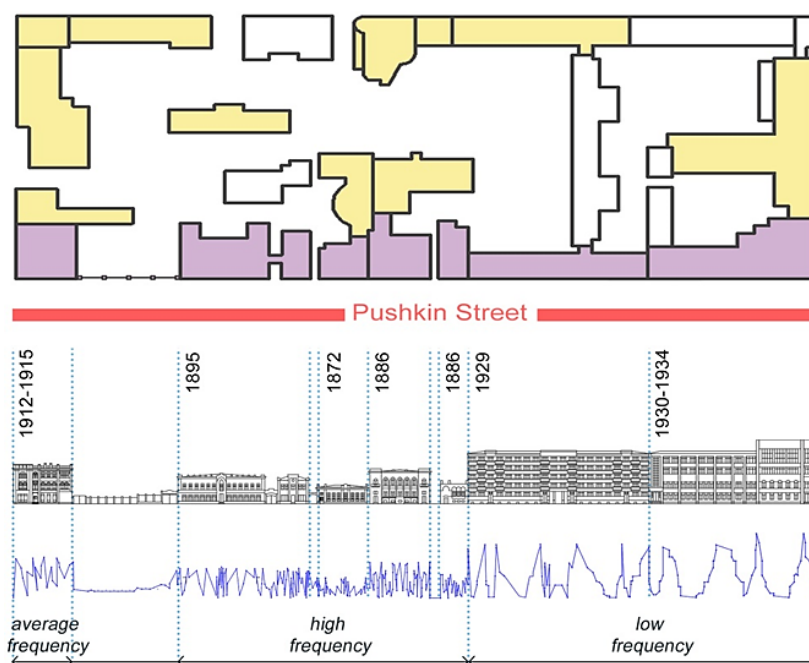


Figure 3. Pushkin Street in Ekaterinburg. Visual analysis. Source: A.V.Leyzerova.

Accordingly, compositional integrity of street silhouette will come about only if structures forming the silhouette are proportional to each other in height (height difference is minimum) or if architectural high-rise dominant is available and background block housing does not prevent perception.

4.2. Social, cultural and transportation aspects

Another no less important aspect influencing street and block sustainability is heavy increase of traffic flow in large and major cities. Traffic on traditional streets creates enough noise and pollution forcing to change functions of most low buildings of the nineteenth century that used to be residential and consequently alive. However, creating offices, cafes, museums, centers for recreation and others in former apartment blocks is feasible if parking places are provided just in the vicinity and there is pedestrian flow sufficient for economic efficiency of these buildings.

Traffic mitigation to the level when noise and pollutants do not exceed admissible standard indicators is economic efficiency indicator to maintain social and cultural sustainability [20]. Historical centre saturated with high-rise residential and office buildings attracts more traffic affecting

housing from previous periods and making human habitation uncomfortable. Due to traffic mitigation on traditional streets cultural and community facilities are organised on first floors of historical buildings. Reducing housing density and limiting workplaces on traditional streets can bring a stimulus for reducing traffic flow and the number of vehicles on parking lots. Therefore, sustainability of traditional streets with geterochronic housing is ensured through traffic mitigation and social function reformatting.

5. Town-planning recommendations for establishing street sustainability

Through the analysis of development, growth and current state of streets in historic district of the city, conditions for social, cultural and architecturally artistic (compositional) street sustainability were identified (figure 4).

To create necessary conditions for maintaining streets as urban structural elements the authors identify the following aspects of sustainability relevant for further investigations:

- social and cultural aspect: conformity to modern culture; conformity to modern functions;
- architecturally artistic aspect: maintenance of urban fabric; maintenance of artistic order and scale; unity of formally compositional characteristics when demolishing old and constructing new;
- transportation aspect: conformity to comfort environment requirements; provision of transport accessibility.

We identified the following conditions for social, cultural and formally compositional sustainability of traditional streets as urban structural elements:

- common type of urban fabric framework;
- silhouette and high-rise characteristics of structures have no critical differences in height;
- duality of geterochronic compositional structure enriches artistic image in perceptual unity;
- existence of strong compositional principle;
- scale characteristics have no critical differences in division size, visual complexity scale differs no more than five gradations;
- mirror symmetry creates additional conditions for compositional sustainability;
- conformity to comfort environment requirements and standard noise and air pollution indicators;
- conformity to the culture of modern society.

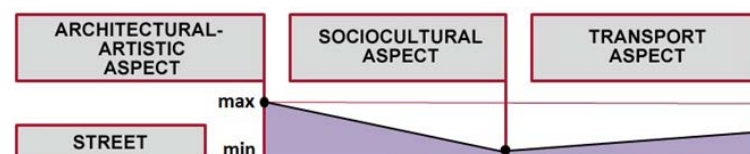


Figure 4. Diagram showing the extent each aspect affects street sustainability.

Developing island historical and cultural districts with one or a diversity of styles facilitates preserving the historical memory and maintaining traditional town-planning values. Achieving street sustainability (as well as other traditional urban structural elements) is possible with laying out traditional streets with one style and geterochronic ribbon building in island historical and cultural districts where traffic load is artificially reduced, social and cultural functions destroying sustainability are excluded, and conditions for geterochronic polyphony are created.

6. Conclusion

The studied issues of transformation, deformation and destruction of traditional streets proved the need to establish, reconstruct or recreate principle urban structural elements under modern social and economic conditions of urban development. We identified new types of streets and defined the most

sustainable one. The developed town-planning recommendations facilitate the sustainability of a street as an urban structural element. Developing island historical and cultural districts is considered to be the main condition to provide sustainability of streets and other urban structural elements.

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